

*Original Research***Adoption of Artificial Insemination and Influence of Extension Services Among Smallholder Dairy Producers in Ekerenyo Division, Nyamira County, Kenya****M. A. Lochampa**

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**Abstract**

The present study was conducted to assess the influence of extension service on adoption of artificial insemination. A descriptive survey design was employed with a sample size of 234 comprising of dairy farmers, groups and key informants. Simple random sample was drawn from farmers undertaking dairy production activities. Purposive sampling was used to identify focus group discussions and key informants. Data was collected using structured questionnaires, interviews and discussions and analyzed using descriptive and inferential statistical techniques in SPSS version 22 programme. Adoption rate of AI was 37.7%. The age of farmers ranged between 25-80 years with average of 45.6 ( $\pm 1.3$ ) years. There were male-headed (71.9%) and female-headed (28.1%) households. All farmers had formal education with majority (68.1%) having completed secondary education and college/university. Mass media gadgets ownership was 79% while membership of farmer based associations was 57.8%. Department of Agriculture, Livestock and Fisheries had reached, 86.1%, mass media programs reached, 29.7%, Non-governmental organizations, 17.7%, faith-based organizations, 3.8% and private institutions, 5.7% of farmers. Agricultural shows and exhibitions 7.5% while neighbours and relatives 20.3% and private institutions 21.4%. Frequently attended extension activities include officer visits (87.7%), trainings, demonstration, field days and study tours were attended by 51.2%, 37.7%, 2.1% and 15.4% respectively. The average distance to nearest extension service provider's office was 5.8 km with majority of farmers (76.5%) living 15km away. Adoption of AI was significantly influenced by education level ( $p < 0.01$ ), herd size ( $p < 0.05$ ), attendance of extension education activities ( $p < 0.05$ ), participation in farmers based groups and social networks ( $p < 0.05$ ), mass media extension programmes ( $p < 0.05$ ) and negatively influenced by farm location from the nearest extension service provider ( $p < 0.05$ ). Adoption of AI is not influenced by age, sex and experience of household head, family size and monthly income of the household head. Extension service optimizes adoption of AI among smallholder dairy producers even though farmers had varied levels of trust, perceptions of reliability and accuracy of extension providers, availability and cost of various extension activities. Strengthening farmers' associations, improving access to mass media programmes and extension education activities and reducing of extension distance will greatly improve adoption of AI.

**Key words:** Artificial Insemination, Extension, Mass Media, Social Networks

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## Introduction

Agriculture today is evolving in an environment of rapid changes in technology, markets, policies, demography and natural environments (Daane, 2010). These challenges are putting new demands on extension service providers in and around the agricultural sector to innovate and develop new ways of improving production so as to satisfy the ever-changing consumer preference and demands. Increasing population, rapid urbanization, land resource degradation, climate change and the present disarray in world commodity markets pose serious challenges. The emerging reforms and changes in knowledge structure of agriculture explicitly indicate that the traditional agricultural extension system alone cannot sufficiently address the demands of the new trends (Agwu *et al.*, 2008). This therefore requires new approaches in development of technology dissemination systems. To be able to develop innovative dissemination systems, assessments of influence of current approaches on technology adoption are needed.

Dairying is an effective tool for rural development, employment and sustained income and it acts as an insurance against several odds. Smallholder dairy farmers are increasingly becoming an important target group for agricultural development programmes in Sub-Saharan Africa (Bebe *et al.*, 2003). Because of their numbers, increasing their productivity and incomes makes a major contribution to reducing extreme hunger and poverty as envisaged in Sustainable Development Goals (SDGs). The use of artificial insemination (AI) as a method of reproduction, particularly in the dairy sector, has been of enormous economic benefit (Vishwanath, 2003). Although better breeding methods exist, AI remains the most commonly adopted by small-scale dairy farmers in developing countries perhaps due to its relative simplicity, high success rate and low cost (Vishwanath, 2003 and Quddus, 2012). However, little is known about the influence of extension education on adoption of AI inasmuch as developing countries continue to fund extension services.

Extension service plays an important role in communicating information about new methods. This is essential in order to create positive perception of the benefit and create favorable attitude towards adoption (England and Stewart, 2007). A reliable extension education should provide useful information to increase farmers' level of awareness and knowledge of the technology (Truong, 2008; Kaaya *et al.*, 2005; Eric *et al.*, 2002; Aïtchédji *et al.*, 2010). This led to the hypothesis that extension education can positively affect adoption of artificial insemination. Various extension providers use different approaches, which are suited to different conditions of smallholders. Smallholder farmers need to be educated regularly to acquire fresh knowledge, information about new trends, best practices and better production techniques and methods (Asam, 2004); this would enable address challenges they face in their production activities (Jorge and

McBruce 2002). In this regard, farmers seek information from various sources; close relatives (Uche *et al.*, 2009), social networks and knowledge spillovers (Kwadwo and Kristin, 2009). Acquisition of information from these sources is not an end in itself but supplement other ways employed by formal extension providers, lack of which will cause them to recede their decision. Eric *et al.* (2002) found that visits by extension personnel in Cameroon reduced the likelihood of farmers choosing 'slash and burn' agriculture which was widely advocated against. In Western Kenya, Makokha *et al.* (2007) notes that farmers with access to extension services were willing to pay extra for a cow with higher milk yield.

The influence of extension on adoption is affected by distance from nearest extension office (Mekonnen *et al.*, 2010), number of staff available, their knowledge and methods used in offering education (Thoung, 2008). On the other hand, decision to adopt depends on farmers' perception, level of trust and reliability of the extension method used, sources, ownership, cost, availability, and accessibility of such information (Uche, *et al.*, 2009). According to Rogers' (1995) innovation decision theory, potential adopters go through five stages when interacting with an innovation.

The purpose of the present study was to assess the influence of extension service on adoption of artificial insemination. Specific objectives of the study were; to assess adoption level of AI services; to find out sources of extension information on AI, to investigate farmers' perception of availability, accuracy, cost, reliability and their level of trust of information on AI and to determine the effect of farmer-based associations and groups, mass media, farm location and attendance of extension education programmes on adoption of AI among small scale dairy producers in Ekerenyo Division, Nyamira County.

## Materials and Methods

The study employed a descriptive survey design. The target population was smallholder dairy farmers in Ekerenyo division approximated at about 600 according to reports at the Department of Livestock Production. The sample size of 234 which corresponds to this population size was determined using Morgan table (Krejcie and Morgan, 1970). The study used stratified sampling procedure where the population in the division was divided into two according to the wards; Ekerenyo and Itibo. Simple random sample was drawn from farmers undertaking dairy production activities. Purposive sampling was used to identify focus group discussions and key informants for the sub-county departmental heads of the Department of Livestock Production, Department of Veterinary Services, Non-Governmental Organizations and institutions providing extension and AI services to farmers' in the division. Data was collected using closed ended questionnaires, key informant interview and focus group discussion schedules on farmer groups. Farmers' responses were categorized into: (a) never adopted (b) adopted. Farmers were categorized as either non-adopter or adopter. Data was edited, coded and entered into SPSS version 22 programme and analyzed using descriptive and inferential statistical techniques i.e. percentages, chi-square and correlation. A logic

function was used to estimate the association between adoption and independent variables using the method used by Gunaseelan *et al.* (2018);

$$\ln(p_i)/1-p_i = \beta_0 + \sum_{j=1}^k \beta_j X_{ij}$$

Where,

$p_i$  - Probability of adoption of AI

$(1-p_i)$  - Probability of non-adoption of AI

$\beta_0$  - Constant term

$\beta_j$  - Coefficients of adoption

$X_{ij}$  - Determinants of adoption of AI

## Results

### Farmers' Adoption of Artificial Insemination

Farmers were categorized as adopters and non-adopters. The table 1 below gives the distribution of farmers. Adoption rate of AI was 37.7%, this means that only slightly above a third of the farmers use AI, the rest use natural service.

### Socio-Economic Characteristics of Farmers

Table 2 below shows socio-economic characteristics of farmers. The age of respondents ranged between 25-80 years with the average age of 45.6 ( $\pm 1.3$ ) years. The highest percentage of respondents (58.3%) were 36-55 years then youths (<36 years), 21.6%, 56-55 years (15.6%) and older farmers (>65 years) at 4.5%. There were more male-headed households (71.9%) than female-headed households (28.1%). All farmers interviewed had attended formal education. Nearly half of respondents had completed secondary education (48%), college/university education (20.1%), lower primary education (1%) and upper primary (30.7%). Majority (26.1%) earned USD.110-150 per month while others earned USD. 60-100 (18.1%) and USD.160-200 (18.1%) and USD.10-50 (21.1%). Only a few earned USD. 210-250 (6.5%) and above USD. 260 (9.5%). Use of mass media usage was shown by ownership of either radio, television set or both; 158 respondents (79%) owned while the rest (20.6%) stated that they do not own either a radio and/or television set. Membership of farmer-based associations constituted only 57.8% of respondents.

### Extension Service Provision and Access

County Government of Nyamira through the Department of Agriculture, Livestock and Fisheries has provided extension to 86.1% of the respondents, 29.7% of respondents accessed extension information from mass media agricultural extension programmes. Other extension service providers include NGOs (17.7%),

faith-based organizations (FBOs) (3.8%) and private institutions (5.7%). Agricultural shows and exhibitions provided information to 7.5% while neighbours and relatives and private institutions provided information to 20.3% and 21.4% of respondents respectively. Since the Structural Adjustment Programmes in 1990s, extension service provision became demand-driven, hence voluntary attendance of extension education activities by farmers became crucial; officer visits were made more frequently (87.7%), trainings, demonstration, field days and study tours were attended by 51.2%, 37.7%, 2.1% and 15.4% respectively. The average distance to nearest extension service provider's office is 5.8 km with the furthest farmer living 36 kms away and nearest farmer 200m. Majority of farmers (76.5%) live 15km from nearest extension provider's office.

### **Farmers' Perception of Availability, Accuracy, Cost, Reliability and Their Level of Trust of Information**

Information from Department of Agriculture, Livestock and Fisheries was considered accurate and reliable by 82.6% of respondents, information from private company, NGOs, FBOs, neighbours/relatives and Radio/TV programmes was considered accurate and reliable by 24.7%, 17.9%, 21.6% and 44.2% respectively. Farmers have very high trust on information from the Department of Agriculture, Livestock and Fisheries (55.4%), information from neighbours/relatives are moderately trusted by 29.7% and information from radio and TV programme were rated high trust by 34.9% and private companies and NGOs are moderately trusted by 24.6% of respondents. Participation in demonstrations, field days and educational tours are considered moderately expensive by 57.9%, 54.9%, and 43.3% while officers' visits and trainings were considered less expensive by 80.5% and 42.7% respectively. Only officer visits were considered readily available by 48.4% of respondents. Field days, demonstrations, field days and educational tours were all considered unavailable by 34.9%, 52.7%, 60.8% and 73.7% of respondents respectively.

### **Discussion**

Adoption of AI in the study area was slightly higher than one reported by Kaaya *et al.* (2005) among Ugandan dairy farmers (36.1%) and Quddus (2012) in Bangladesh and Tebug *et al.* (2012); and lower than reported by Rezvanfar, (2007) and Temba (2011) in Tanzania. The cost of semen, the cost of insemination, lack of awareness, lack of knowledge about time of mating and success rate (Quddus, 2012), the notion that AI produce more bull calves than females. Instantaneous high expectations of AI service which are rarely met, higher chances of dystocia and limited number of veterinary practitioners to attend to the dystocia (Mugisha *et al.*, 2014), might have contributed to low uptake of AI by small scale dairy farmers in the area. It was confirmed by FDGs that natural services are less expensive compared to AI even though the County Government of Nyamira had a subsidy AI programme where charges are reduced to USD. 5 and repeat

cases are not charged. However, key informants argued that adoption of AI has improved since the introduction of the subsidy AI programme.

The average age of dairy farmers was the same as reported by Omondi and Meinderts (2010) in Limuru, Kenya and by Farah and Bahaman (2013) in Malaysia and slightly lower than one reported by Wambugu *et al.* (2011) and higher than one documented by Girima and Marco (2014) in Ethiopia (41 years). This means there is relatively older farming population in Kenya than Ethiopia. The proportion of males and females is higher than one reported by Girima and Marco (2014) in Ethiopia and lower than one by Wambugu *et al.* (2011) in Kenya that eighty-eight (88) percent of dairy households are male headed. Data on education reported are higher than reported by Girima and Marco (2014) in Ethiopia at 64% completed primary education, not schooled (14%) secondary (20%). This means that there are more educated farmers in study area than they are in Ethiopia. This slightly varies with one reported by Wambugu *et al.* (2011) that in Kenya (38% secondary education, 39% primary education, 8% had no formal education and only 5% had acquired university degree). The education level of interviewed respondents is higher than reported by Girima and Marco (2014). Education level influenced significant adoption of artificial insemination ( $p < 0.01$ ). It is often assumed that educated farmers are better able to process information and search for appropriate technologies to alleviate their production constraints. It is believed that education enables farmers perceive, interpret and respond to new information faster (Matata *et al.*, 2010). Adoption of AI was not influenced by age, sex and experience of household head, family size and monthly income of the household.

Herd size had significant influence ( $p < 0.05$ ) on adoption of AI meaning that farmers with more cows in their herds would adopt AI this could be because of large herd sizes. Adoption is influenced ( $p < 0.05$ ) by participation in farmers based groups and social networks. This agrees with the findings of Kaaya *et al.* (2005) who reported that agricultural knowledge is affected by communal learning and doing; probably because such groups increase information acquisition through interaction and meetings. This finding was reiterated by key informant who divulged that groups have been a major entry point of extension because through them extension reached many farmers frequently participate in training programs, meet and exchange with several partners, and are in contact with the extension agents (Aitchédji *et al.*, 2010). Farmers meet at social functions and discuss issues of concern, learn from each other and knowledge is carried from one community to another (Kwadwo and Kristin, 2009). Further, individual attitudes and behavior are influenced toward agreement by the social microstructure by linking the individual to the larger society and exposes him to a variety of ideas (Asam, 2004).

Mass media programmes significantly influenced adoption of AI ( $p < 0.1$ ). This agrees with Kaya *et al.* (2011). This is because mass media create knowledge and spreads information thus leading to changes in weakly held attributes thereby increasing the farmer's ability to obtain and use information relevant to the

adoption of dairy technologies (Asam, 2004). Adoption of AI was influenced by farm distance from the nearest extension provider. Correlation analysis indicated strong negative relationship with adoption of AI ( $p < 0.05$ ); this means that the nearer a farmer is to the nearest extension provider's office the more likely he would adopt AI. This could be because the nearer the farmer the lower the transport cost and also it is easy to make frequent trips to extension provider to access to information.

### Conclusion and Recommendations

Extension Education optimizes adoption of AI among smallholder dairy producers. Farm location, use of mass media, participation in farmer based associations and attendance of extension education programmes have significant positive influence on adoption. Farmers had varied levels of trust, perceptions of reliability, accuracy, of various extension providers. Farmers equally had different perceptions of availability and cost of various extension approaches. Therefore, Farmers' participation in associations, improving access to mass media programmes and extension education activities and reducing of extension distance will greatly improve adoption of AI.

Focus should be given to increase the capacity of extension service providers to reach more farmers through farm visits, trainings, use mass media and farmer-based groups to achieve the higher level of dissemination or success in adoption of AI.

### Abbreviations

**AI:** Artificial Insemination; **FBO:** Faith Based Organizations; **NGOs:** Non-Governmental Organizations

**Competing Interest** - The author declares that they have no competing interest.

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